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16 FEB 1966

MEMORANDUM FOR: Deputy Director for Science and Technology
SUBJECT : Retrofit of Aircraft with 34K Engines

1. This memorandum requests a concurrence of the Deputy Director for Science and Technology. Such request is contained in paragraph 6.

2. It is recommended that a program be established to retrofit the A-12 aircraft fleet with 34,000 pound thrust J-58 engines. Presently we know that the 34K engine will provide the following:

- a. Improved climb with one engine out at takeoff.
- b. Improved climb with both engines operating.
- c. Increased airplane limit weight or altitude for level flight with one engine out.

Some of the questions for which we have no firm flight test substantiated answers, though we have positive estimated indications, are:

- a. Higher refueling altitude.
- b. Extended range of 150 nautical miles due to shorter time to climb.
- c. Greater durability than the YJ engine.
- d. Greater time between overhauls.
- e. A reduction of 25% in engine maintenance and overhaul costs.

Detailed estimates supporting the above statements are contained in Attachments II and III.

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3. Present and future planning dictates the need for 66 34K engines (if complete retrofit is decided) in order to support the ten OXCART and the three KEDLOCK aircraft. We know of no relief at present from supporting the three KEDLOCK aircraft. If however, the three KEDLOCK aircraft support is to be eliminated then ten engines may be deducted from the total, leaving 56 engines to support OXCART alone. The planning to substantiate the 66 engines for OXCART and KEDLOCK is shown on Attachment I.

4. The present engine production line is due to close during May 1967. Eighteen months lead time after receipt of order is required to keep the line open. This dead-line for go-ahead was 31 December 1965, however Pratt and Whitney feels arrangements may be made to absorb the existing gap. If there is a significant break in the production line, the lead time will increase to a minimum of 24 months and unit cost should increase considerably over the present [redacted] dollars budgeted.

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5. In order to allow time for additional flight testing to get exact answers to range and refueling improvements indicated above, and at the same time prevent a major gap in the engine production line, it is recommended that an interim buy of 15 engines be immediately authorized. This will allow approximately four months of additional testing to confirm desirability to complete retrofit. Whether or not complete retrofit is deemed necessary, the programs are critically short of engines, and the additional fifteen can be very profitably employed in support of the two operating locations now planned. Further, with the performance estimates cited above, some flight test substantiation to date, and considerable ground development test substantiation it is felt that a decision for this initial buy of 15 engines involves a minimum of risk. This is supported by the USAF decision for complete changeover to 34K engine production now underway and complete retrofit of the existing J engine fleet.

6. If you concur in principle, I will prepare a briefing and formal proposal for the NRO.

SIGNED

JACK C. LEDFORD
Brigadier General, USAF
Director of Special Activities

CONCUR:

[redacted]

21 FEB 1966

Deputy Director for Science and Technology

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ATTACHMENT NO. I

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34K ENGINE SUPPORT REQUIREMENT

The following based on discussions 21 December 1965 and
2 February 1966 among [redacted]
and [redacted]

1. Anticipated flight requirements now through 1970:

- a. Approx 500 engine hours per month;
Based on:

2 Flight Test Aircraft @ 15 hrs/mo	-	30 hrs/mo.
8 Detachment Aircraft @ 20 hrs/mo	-	160 hrs/mo.
3 Kedlock Aircraft @ 20 hrs/mo	-	60 hrs/mo.

Total Aircraft hrs/mo.	250
Total Engine hrs/mo.	500

- b. Approximately 50% of 500 engine hours per month will be at Mach 3.0 and above based on one training flight and one functional check flight for each mission or simulated mission as based upon the following experience breakdown:

Ave Training Flight	2 hrs total	1 hr Mach 3.0
Ave Functional Check	1.5 hrs total	0.6 hr Mach 3.0
Ave Mission	6 hrs total	3.1 hrs Mach 3.0
	9.5 hrs	4.7 hrs Mach 3.0

or $\frac{4.7 \text{ hrs Mach 3}}{9.5 \text{ total hrs}} \approx 50\%$

and $50\% \times 500 = 250 \text{ eng. hrs/mo. Mach 3}$

2. Anticipated 1967 34K engine TBO:
Probably similar to J engine TBO in 1967, which should be 100 hrs, TBO at Mil. Power and hopefully 50 hrs. TBO at Mach 3.0, the latter based on projecting the now existing J engine HSI of 15 hrs. at Mach 3.0 to 25 hrs. at Mach 3.0 in 1967.
3. Combining the flight requirements of paragraph 1 with the engine available TBO's of paragraph 2 and noting that all flight time is at mil. power, the following results:

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- a. Mil. Time \approx flight time therefore

$$\frac{500 \text{ eng. flight hrs. req'd/mo.}}{100 \text{ hrs. TBO mil. power}} = 5 \text{ engs/mo.}$$
to overhaul for mil. time
- or
- b. Mach 3.0 time:

$$\frac{250 \text{ eng. flight hrs Mach 3.0 req'd/mo.}}{50 \text{ hrs. TBO Mach 3.0}} = 5 \text{ engs/mo.}$$
to overhaul for Mach 3.0 time.

Note that the 100 hrs. mil. time and the 50 hrs. Mach 3.0 time TBO's both result in 5 engs/mo. to overhaul because the Mach 3.0 flight hour requirement is 50% of the total.

- c. Adding one engine per month to overhaul to paragraph 2B or 2C to allow for prematures, results in 6 engs/mo. to overhaul.
- d. Present overhaul turnaround time of three months should be reduced in 1967 to 2.5 months but only by continued pressure on the contractor.

4. A total of 66, 34K engines are required to support the OXCART and KEDLOCK requirements of paragraph 1 according to the following distribution:

Installed (13 aircraft)	26 engines
Overhaul (6 engs/mo. x 2.5 mos. TAR)	15 engines
Field Ready Spares:	
[redacted] (2 F/T + 3 Kedlock + 4 Detach. birds)	6 engines
Kadona (4 Detach. birds)	4 engines
Field Shops: (HSI, repairs, mods.)	
[redacted]	10 engines
Kadona	2 engines
In or Waiting Transit [redacted] Kadona,	
Hartford)	3 engines
Total	<u>66 engines</u>

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5. Presently the first production 34K engine availability date is June 1967, (3 engines), at which time the present 34K engine production line runs out. This availability was contingent upon go-ahead no later than 31 December 1965, (18 months lead). See Attachment IV for 34K engine deliveries. Unit cost advantages will probably be realized if orders are placed such as to be compatible with the current line end point without interruption. If the current delivery rate of 3 engines per month is maintained, it would be Spring 1969 before the 66th 34K engine is delivered to the OXCART/KEDLOCK support. This rate is obviously faster than the presently planned rate of 22 engs/year which would not reach completion until May 1970.

6. If the above 34K delivery posture is authorized, the last delivery will be Spring 1969. This points up the advisability of proceeding with the currently planned Y and J performance conversion in order to provide the best configuration available until complete replacement by the production 34K's in 1969.

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ATTACHMENT NO. II

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PERFORMANCE

Lockheed calculated estimates indicate that: the 34K engine will provide a 3,000 pound fuel advantage at the start of cruise which results in a range improvement of 150 nautical miles over the Y engine due to the increased thrust of the 34K engine. The improved climb performance results in an increase in the climb rate of 1,000 feet per minute. This realizes a reduction in the required time to climb to altitude and a 20 nautical mile reduction in the distance traveled while climbing to altitude. A very significant improvement from a flight safety point of view is a rate of climb of 400 feet per minute, compared to the current zero rate of climb, in a single engine situation occurring immediately after takeoff with a gross weight of 120,000 lbs. We would also realize a higher single engine cruise altitude or airplane limit weight. Although unproven, at this point we can also expect to achieve a higher air-refueling altitude and increased engine flexibility while in the air refueling operation.

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ATTACHMENT NO. III

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MAINTENANCE AND OVERHAUL ECONOMICS

1. Based on a 500 engine hour per month program in FY'67 and an increase in flight activity through 1971 commensurate with growth potential of the engine in terms of decreased inspections and overhauls, the 34K engine retrofit should pay for itself in approximately seven years. This projection is derived from a planned expenditure of approximately 50 million dollars per year to support inspection and overhaul of the Y engine versus an expected lower level of expenditure with the 34K engine. If experience confirms the anticipation that the 34K engine will require 25% less support than the prototype engines, the resulting savings of [] per year would provide capitalization for about nine of the 34K engines per year.

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In addition, spare parts availability would be improved for supporting 34K rather than Y engines because of the existing and proposed additional 34K engine production operations. Also, eventual elimination of the Y engine will permit a single engine model or type spares inventory at the overhaul facility and at operating locations rather than a separate inventory for the Y and a separate inventory for the 34K.

2. The Y version of the J-58 engine currently in use requires a hot section inspection after 10 hours at Mach 3 flight or 40 hours of total flight time. The engines are scheduled to be returned for overhaul when the second hot section inspection is required. Effort is now being directed toward a 15 hour Mach 3 and 50 hour hot section inspection for the Y-J engines. These improved hot section inspection times cannot be verified however, until increased times have been accumulated on enough engines to demonstrate the improvement. Project Y service engines are now undergoing modification as they are cycled through overhaul to take advantage of performance improvements achieved in the full "J" model. This will result in a J type performance engine inventory for our fleet and hopefully some improvement in hot section and overhaul times. Pratt & Whitney has projected an improvement in the flight time hot section inspection period of 10 hours per year through 1971. This trend will undoubtedly be

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obtained with full J engines and the 34K engine. It is not expected that our Y engines will follow this pattern closely due to basic differences in the prototype and production engines and stresses imposed during flight testing. The unknown areas of such stresses affecting the prototype engine life could be expected to result in a twenty-five percent differential in required maintenance of a Y engine compared to a 34K engine.

3. The possibility of further conversion of our present engines to the higher thrust (34K) version is not very likely unless additional Y to 34K conversion compatibility development testing is authorized. Pratt & Whitney does not recommend this course due to the fact that follow-on development and product improvement testing has been directed toward the production model engines and separate and costly testing would have to be funded for the Y prototype engines. Additionally, as problems arise with the Y engine, development funds are expended and engineering effort diverted to their solution to the detriment of further improvements to the production model engine. Conceivably with only the 34K - J-58 in the inventory, savings of development time, effort and costs could be realized.

4. Many potentially significant improvements are now showing promise in the J engine development program such as improved cruise fuel consumption, improved tolerance to inlet system imposed distortion, and improved afterburner performance and durability which may not be realized by the Y engine. Furthermore, the DNRO has already expressed concern over expending development funding and effort on relatively tired engines.

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JT11 34K ENGINE PRODUCTION SCHEDULE

	1966												1967											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Production Delivery of 34K Engine	<—Current Earning/Tagboard—												*Proposed Oxcart/Kedlock*											
	1	3	3	3	3	3	2	3	3	3	3		3	3	3	3	3	3	2	3	3	3	3	
	1968												1969											
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
	<—Proposed Oxcart/Kedlock—																							
	3	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2								

Total
Oxcart/Kedlock

66

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